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ESTIMATION SYSTEM, ESTIMATION METHOD, AND PROGRAM FOR HARNESS PROCESSING

BACKGROUND OF THE INVENTION

5   Field of the Invention

The present invention relates to an estimation system, an estimation method and a program for harness processing.

Description of the Related Art

10   A harness incorporated into cars and various electronic apparatuses as their component is constituted by making insulation-displacement-crimping (IDC) or crimp-connecting (CC) of connectors to both ends of a plurality of electric wires.   In the manufacturing process of a harness, processing instruments such as a

15   crimp-connecting machine and an insulation-displacement-crimping machine are used.

It is important to grasp how much it costs to manufacture a harness by using the above-mentioned processing instruments, and to grasp beforehand the time required in each process step, in order to

20   realize a higher efficiency for harness designing, a success in a negotiation, and optimization of process step management and staff member allocation.   Accordingly, there has been a demand for realization of an estimation system which receives input of manufacturing conditions of a harness for which estimation is

25   requested, and can quickly output a highly objective manufacturing

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cost of the harness required if the harness is manufactured with the
input manufacturing conditions.

Unexamined Japanese Patent Application KOKAI Publication
No. 2000-285123 discloses a computer system which memorizes and
5 outputs prices of various kinds of components.   However, the
computer system can not estimate the components.   More
specifically, it can not estimate the time and cost to manufacture
components, time and cost required in each process step for
manufacturing the components, and so on.

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SUMMARY OF THE INVENTION

An object of the present invention made under such situations is
to provide an estimation system, an estimation method, and a
program for making it possible to quickly output an estimated cost
15 for manufacturing a harness, which is in accordance with
manufacturing conditions designated by the estimation requester.

To achieve the above object, an estimation system for harness
processing according to a first aspect of the present invention
comprises: a storage unit which is constituted by a memory medium
20 or memory elements, and which stores an estimation function for
calculating an estimation of a harness based on a designated
processing condition for processing the harness; an input unit which
receives input of information; and a control circuit which calculates
the estimation of the harness based on the estimation function read
25 out from the storage unit and the processing condition designated

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from the input unit.

The estimation system for harness processing may comprise a
communication unit which receives the estimation function and
stores the received estimation function in said storage unit.

5   The input unit may comprise a communication unit which
receives the processing condition from an external terminal and
provides the received processing condition to the control circuit, and
sends an estimation result for the harness calculated by the control
circuit to the external terminal.   In this case, the external terminal to

10   which the estimation result is sent is a specific terminal, and the
control circuit may confirm that the external terminal is the specific
terminal until at least before the estimation result is sent to the
external terminal, and then may send the estimation result to the
external terminal via the communication unit.

15   The estimation function for the harness may be a function for
calculating a unit component price of the harness based on the
processing condition for the harness.

The estimation system for harness processing may comprise an
output unit which outputs information, and the control circuit may

20   perform a1) a step of acquiring the processing condition for the
harness which is designated from the input unit, b1) a step of storing
the designated processing condition in the storage unit, c1) a step of
reading out the designated processing condition from the storage unit,
d1) a step of reading out the estimation function from the storage unit,

25   e1) a step of calculating the unit component price of the harness that

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corresponds to the designated processing condition, based on the read-out estimation function and a content of the designated processing condition, f1) a step of storing the calculated unit component price in the storage unit, g1) a step of reading out the unit

5 component price from the storage unit, and h1) a step of outputting the read-out unit component price via the output unit.

The estimation function stored in the storage unit may be an operation time estimation function for calculating, based on the processing condition, an instrument operation time of each process

10 step for processing the harness by using a harness processing instrument.

In this case, the control circuit may perform a2) a step of acquiring the processing condition designated for each process step via the input unit, b2) a step of storing the designated processing

15 condition in the storage unit, c2) a step of reading out the designated processing condition from the storage unit, d2) a step of reading out the operation time estimation function from the storage unit, e2) a step of calculating the instrument operation time of each process step based on the read-out operation time estimation function and the

20 designated processing condition, and f2) a step of storing the calculated instrument operation time of each process step in the storage unit.

The "instrument operation time" is a time during which a processing instrument is operated for processing the harness for

25 which estimation is to be made.

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Further, the storage unit may store an operation cost estimation

function for calculating, based on the instrument operation time, an

instrument operation cost that is required for processing the harness

using the harness processing instrument, and the control circuit may

5　perform a3) a step of reading out the calculated instrument operation

time of each process step from the storage unit, b3) a step of reading

out the operation cost estimation function from the storage unit, c3) a

step of calculating the instrument operation cost of each process step

based on the read-out instrument operation time of each process step

10　and the operation cost estimation function, and d3) a step of storing

the calculated instrument operation cost of each process step in the

storage unit.　The "instrument operation cost" is a material cost

arising from operating the harness processing instrument.

Further, the storage unit may store a work time estimation

15　function for calculating an instrument work time which is required

for processing the harness using the harness processing instrument,

based on the designated processing condition, and the control circuit

may perform a4) a step of reading out the work time estimation

function from the storage unit, b4) a step of calculating the

20　instrument work time of each process step based on the read-out

work time estimation function and the designated processing

condition, and c4) a step of storing the calculated instrument work

time of each process step in the storage unit.　The "instrument work

time" is a time during which a worker using the harness processing

25　instrument does his/her works for processing the harness for which

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estimation is to be made.

Further, the storage unit stores a labor cost estimation function for calculating, based on the instrument work time, an instrument labor cost that is required for processing the harness using the

5 harness processing instrument, and the control circuit may perform a5) a step of reading out the calculated instrument work time of each process step from the storage unit, b5) a step of reading out the labor cost estimation function from the storage unit, c5) a step of calculating the instrument labor cost of each process step based on

10 the read-out instrument work time of each process step and the labor cost estimation function, and d5) a step of storing the calculated instrument labor cost of each process step in the storage unit. The "instrument labor cost" is a labor cost (personnel expense) arising from operating the harness processing instrument.

15 Further, the storage unit may store a planning time estimation function for calculating, based on the designated processing condition, a planning time before processing the harness using the harness processing instrument, and the control circuit may perform a6) a step of reading out the planning time estimation function from

20 the storage unit, b6) a step of calculating the planning time of each process step based on the read-out planning time estimation function and the designated processing condition, and

c6) a step of storing the calculated planning time of each processing step in the storage unit. The "planning time" is a time required for

25 preparation in a stage before operating the harness processing

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instrument.

Further, the storage unit may store a planning cost estimation function for calculating, based on the planning time, a planning cost required for processing the harness using the harness processing
5   instrument, and the control circuit may perform a7) a step of reading out the calculated planning time of each process step from the storage unit, b7) a step of reading out the planning cost estimation function from the storage unit, c7) a step of calculating the planning cost of each process step based on the read-out planning time of each
10   process step and the planning cost estimation function, and d7) a step of storing the calculated planning cost of each process step in the storage unit.   The "planning cost" includes a material cost and a labor cost arising in the stage before operating the harness processing instrument.

15   Further, the control circuit performs a8) a step of reading out the calculated instrument operation cost, instrument labor cost, and planning cost of each process step from the storage unit, b8) a step of calculating a processing cost required for processing the harness using the harness processing instrument, by adding up the read-out
20   instrument operation cost, instrument labor cost, and planning cost, and c8) a step of storing the calculated processing cost in the storage unit.

The estimation system may further comprise an output unit which outputs information, and the control circuit may perform a9) a
25   step of reading out the calculated processing cost from the storage

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unit, and b9) a step of outputting the read-out processing cost via the output unit.

Further, the control circuit may perform a10) a step of reading out the calculated instrument operation time, instrument work time,
5 and planning time from the storage unit, and b10) a step of outputting the read-out instrument operation time, instrument work time, and planning time via the output unit.

To achieve the above object, an estimation system according to a second aspect of the present invention comprises: a storage unit
10 which stores information; an input unit which receives input of information; and a control circuit which controls operations of the storage unit and input unit, the storage unit stores a component database associating a quantity of child components necessary for manufacturing each harness and a unit child component price of the
15 child components with identification information of each harness, and also stores a material cost estimation function for calculating a material cost of each harness by inputting thereto, the quantity and the unit child component price, and the control circuit performs a11) a step of acquiring identification information of a harness for which
20 estimation is to be made via the input unit, b11) a step of reading out the quantity and the unit child component price associated with the acquired identification information of the harness from the component database in the storage unit, c11) a step of reading out the material cost estimation function from the storage unit, d11) a step of
25 calculating the material cost of the harness corresponding to the

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acquired identification information, based on the read-out material

cost estimation function and the read-out quantity of child

components and unit child component price, and e11) a step of

storing the calculated material cost in the storage unit.

5   In this case, the estimation system may comprise an output unit

which outputs information, and the control circuit may perform a12)

a step of creating a component screen displaying the read-out

quantity of child components and unit child component price, and

outputting the created component screen via the output unit, b12) a

10   step of acquiring a change of the quantity of child components and/or

unit child component price displayed on the component screen, via

the input unit, and c12) a step of calculating the material cost of the

harness based on the changed quantity and unit child component

price and the material cost estimation function.

15   To achieve the above object, an estimation method according to

a third aspect of the present invention is a method for causing a

control circuit to calculate an estimation of a harness based on an

estimation function read out from a storage unit and a processing

condition designated from an input unit, in a system comprising: the

20   storage unit which is constituted by a memory medium or memory

elements, and which stores the estimation function for calculating an

estimation of a harness based on a designated processing condition

for processing the harness; the control circuit; and the input unit

which receives input of information.

25   A communication unit may be provided to the system, and the

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estimation method may cause the communication unit to receive the estimation function and store the received estimation function in the storage unit.

A communication unit may be provided to the input unit, and the

5   estimation method may cause the communication unit to receive the processing condition from an external terminal, provide the received processing condition to the control circuit, and send an estimation result for the harness calculated by the control circuit to the external terminal.

10   To achieve the above object, a program according to a fourth aspect of the present invention controls a control circuit to perform an operation of calculating an estimation of a harness based on an estimation function read out from a storage unit and a processing condition designated from an input unit, in a system comprising: the

15   storage unit which is constituted by a memory medium or memory elements, and which stores the estimation function for calculating an estimation of a harness based on a designated processing condition for processing the harness; the input unit which receives input of information; and the control circuit.

20   The system may comprise a communication unit which receives the estimation function and stores the received estimation function in the storage unit.

The input unit may comprise a communication unit which receives the processing condition from an external terminal, provides

25   the received processing condition to the control circuit, and sends an

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estimation result for the harness calculated by the control circuit to the external terminal.

In this case, the external terminal to which the estimation result is sent may be a specific terminal, and the program may control the
5　control circuit to confirm that the external terminal is the specific terminal until at least before the estimation result is sent to the external terminal, and then send the estimation result to the external terminal via the communication unit.

The estimation function for the harness may be a function for
10　calculating a unit component price of the harness based on the processing condition for the harness.

In this case, the system may comprise an output unit which outputs information; and the program may control the control circuit to perform a1) a step of acquiring the processing condition for the
15　harness which is designated from the input unit, b1) a step of storing the designated processing condition in the storage unit, c1) a step of reading out the designated processing condition from the storage unit, d1) a step of reading out the estimation function from the storage unit, e1) a step of calculating the unit component price of the harness that
20　corresponds to the designated processing condition, based on the read-out estimation function and a content of the designated processing condition, f1) a step of storing the calculated unit component price in the storage unit, g1) a step of reading out the unit component price from the storage unit, and h1) a step of outputting
25　the read-out unit component price via the output unit.

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In this case, the estimation function stored in the storage unit may be an operation time estimation function for calculating, based on the processing condition, an instrument operation time of each process step for processing the harness during which a harness

5   processing instrument is operated.

Further, the program may control the control circuit to perform: a2) a step of acquiring the processing condition designated for each process step via the input unit, b2) a step of storing the designated processing condition in the storage unit, c2) a step of reading out the

10 designated processing condition from the storage unit, d2) a step of reading out the operation time estimation function from the storage unit,e2) a step of calculating the instrument operation time of each process step based on the read-out operation time estimation function and the designated processing condition, and f2) a step of storing the

15 calculated instrument operation time of each process step in the storage unit.

Further, the storage unit may store an operation cost estimation function for calculating, based on the instrument operation time, an instrument operation cost that is required for processing the harness

20 using the harness processing instrument, and the program may control the control circuit to perform a3) a step of reading out the calculated instrument operation time of each process step from the storage unit, b3) a step of reading out the operation cost estimation function from the storage unit, c3) a step of calculating the

25 instrument operation cost of each process step based on the read-out

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instrument operation time of each process step and the operation cost
estimation function, and d3) a step of storing the calculated
instrument operation cost of each process step in the storage unit.

Further, the storage unit may store a work time estimation

5   function for calculating an instrument work time which is required
for processing the harness using the harness processing instrument,
based on the designated processing condition, and the program may
control the control circuit to perform:a4) a step of reading out the
work time estimation function from the storage unit, b4) a step of

10 calculating the instrument work time of each process step based on
the read-out work time estimation function and the designated
processing condition, and c4) a step of storing the calculated
instrument work time of each process step in the storage unit.

Further, the storage unit may store a labor cost estimation

15 function for calculating, based on the instrument work time, an
instrument labor cost that is required for processing the harness using
the harness processing instrument, and the program may control the
control circuit to perform a5) a step of reading out the calculated
instrument work time of each process step from the storage unit, b5)

20 a step of reading out the labor cost estimation function from the
storage unit, c5) a step of calculating the instrument labor cost of
each process step based on the read-out instrument work time of each
process step and the labor cost estimation function, and d5) a step of
storing the calculated instrument labor cost of each process step in

25 the storage unit.

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Further, the storage unit may store a planning time estimation
function for calculating, based on the designated processing
condition, a planning time before processing the harness using the
harness processing instrument, and the program may control the
5   control circuit to perform:a6) a step of reading out the planning time
estimation function from the storage unit, b6) a step of calculating the
planning time of each process step based on the read-out planning
time estimation function and the designated processing condition,
and c6) a step of storing the calculated planning time of each
10 processing step in the storage unit.

Further, the storage unit may store a planning cost estimation
function for calculating, based on the planning time, a planning cost
required for processing the harness using the harness processing
instrument, and the program may control the control circuit to
15 perform:a7) a step of reading out the calculated planning time of each
process step from the storage unit, b7) a step of reading out the
planning cost estimation function from the storage unit, c7) a step of
calculating the planning cost of each process step based on the
read-out planning time of each process step and the planning cost
20 estimation function, and d7) a step of storing the calculated planning
cost of each process step in the storage unit.

Further, the program may control the control circuit to perform:
a8) a step of reading out the calculated instrument operation cost,
instrument labor cost, and planning cost of each process step from the
25 storage unit, b8) a step of calculating a processing cost required for

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processing the harness using the harness processing instrument, by adding up the read-out instrument operation cost, instrument labor cost, and planning cost, and c8) a step of storing the calculated processing cost in the storage unit.

5　　　　The system may comprise an output unit which outputs information, and the program may control the control circuit to perform:a9) a step of reading out the calculated processing cost from the storage unit, and b9) a step of outputting the read-out processing cost via the output unit.

10　　　　The program may control the control circuit to perform:a10) a step of reading out the calculated instrument operation time, instrument work time, and planning time from the storage unit, and b10) a step of outputting the read-out instrument operation time, instrument work time, and planning time via the output unit.

15　　　　The present invention is structured as described above and functions as described above.　Therefore, the present invention can provide an estimation system which quickly outputs an estimated value of a harness in accordance with a processing condition designated by an estimation requester.

20　　　　　　　　BRIEF DESCRIPTION OF THE DRAWINGS

These objects and other objects and advantages of the present invention will become more apparent upon reading of the following detailed description and the accompanying drawings in which:

FIG. 1 is a block diagram showing an entire structure of an

25　estimation system according to a first embodiment of the present

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invention;

FIG. 2 is a diagram showing a main screen;

FIG. 3 is a diagram showing a processing information screen for insulation-displacement-crimping;

5　FIG. 4 is a diagram showing an example of a navigator display section;

FIG. 5 is a diagram showing a processing information screen for crimp-connecting;

FIG. 6 is a diagram showing a processing information screen for 10　wiring preparation works/wiring;

FIG. 7 is a diagram showing a processing information screen for wiring-related works/continuity check/appearance check;

FIG. 8 is a flowchart showing a processing cost calculation operation;

15　FIG. 9 is a diagram showing a table defining operation times;

FIG. 10 is a diagram showing a table defining operation times;

FIG. 11 is a diagram showing a table defining operation times;

FIG. 12 is a diagram showing a table defining operation times;

FIG. 13 is a diagram showing a table defining operation times;

20　FIG. 14 is a diagram showing a table defining operation times;

FIG. 15 is a diagram showing a table defining operation times;

FIG. 16 is a diagram showing a table defining operation times;

FIG. 17 is a diagram showing a table defining operation times;

FIG. 18 is a diagram showing a table defining operation times;

25　FIG. 19 is a diagram showing a table defining operation times;

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FIG. 20 is a diagram showing a table defining operation times;

FIG. 21 is a diagram showing a table defining operation times;

FIG. 22 is a diagram showing a table defining operation times;

FIG. 23 is a diagram showing a time factor setting table;

5   FIG. 24 is a diagram showing a processing cost ratio master

table;

FIG. 25 is a diagram showing a unit component price screen;

FIG. 26 is a diagram showing a processing cost display screen;

FIG. 27 is a diagram showing an

10   insulation-displacement-crimping step setting screen;

FIG. 28 is a diagram showing a crimp-connecting step setting

screen;

FIG. 29 is a flowchart of an insulation-displacement-crimping

machine selection operation;

15   FIG. 30 is a flowchart of a crimp-connecting machine selection

operation;

FIG. 31 is a diagram showing a process step setting table;

FIG. 32 is a diagram showing a process step setting table;

FIG. 33 is diagram showing a processing information screen for

20   wiring-related works/continuity check/appearance check;

FIG. 34 is a diagram showing an environmental impact

information table;

FIG. 35 is a block diagram showing a structure of an estimation

system according to a second embodiment;

25   FIG. 36 is a flowchart showing an estimation method of the

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estimation system shown in FIG. 35.

FIG. 37 is a block diagram showing a structure of an estimation system according to a third embodiment; and

FIG. 38 is a flowchart showing an estimation method of the

5　estimation system shown in FIG. 37.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention will now be explained with reference to the drawings.

10　[First Embodiment]

FIG. 1 is a block diagram showing the entire structure of an estimation system 40 for harness processing, according to a first embodiment of the present invention.

The estimation system 40 comprises a storage unit 41, an input

15　unit 42, an output unit 43, and a control unit 44.

The storage unit 41 can be constituted by, for example, a RAM (Random Access Memory) constituted by storage elements, a ROM (Read Only Memory), a hard disk, or various recording media.

Physically, the storage unit 41 may be constituted by one unit, or

20　may be constituted by a plurality of units.

The storage unit 41 stores an estimation function for calculating a unit component price of a harness.　The unit component price of a harness can be broken down into a material cost, a processing cost, a material loss cost, a material management cost, a general

25　management cost, a profit margin, a transportation cost, and a

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transportation/material handling cost.　The storage unit 41 stores a

function for calculating an estimation for each of these cost

categories.　The storage unit 41 further stores a table defining

calculation factors to be input to the estimation function.　The

5　storage unit 41 further stores a component database in which the

quantity of child components necessary for manufacturing each

harness and unit price of the child component are associated with

identification information of each harness, and a unit component

price database.

10　　　The input unit 42 includes, for example, a keyboard and a

pointing device such as a mouse.

　　　The output unit 43 is, for example, a computer display.

　　　The control unit 44 comprises, for example, a CPU (Central

Processing Unit) as a control circuit.　The control unit 44 may

15　further comprise a plurality of calculation means for performing a

distribution operation.

　　　As described above, the unit component price of a harness is

made up of a material cost, a processing cost, a material loss cost, a

material management cost, a general management cost, a profit

20　margin, a transportation cost, and a transportation/material handling

cost, and the unit component price is calculated by adding up these

costs.　The estimated cost for each of these cost categories is

calculated based on information input from a processing condition

input screen and the estimation function stored in the storage unit 41.

25　Therefore, the structure of the processing condition input screen will

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be explained first.

The processing condition input screen according to the present embodiment includes a main screen and a processing information screen shifted from the main screen.

5   FIG. 2 is a diagram showing the main screen.

A component number input section a1 and a suffix input section a2 are arranged in an upper row of the main screen.   According to the present embodiment, it is arranged that when estimation for a harness is conducted, information on child components constituting

10   the harness for which the estimation is conducted should be stored as log data.   This is for making it possible for other people to read out the log afterwards and use it.   The component number and suffix are used as identifies for this estimation log.

A monthly lot input section a3 is provided in a middle row of the

15   main screen.   A monthly production quantity of a harness for which estimation should be conducted is input in this section a3.

A component constitution information section a4 is further provided in a middle row of the main screen.   The level, component number; suffix (SFX), quantity, unit price, total price, kind, etc. are

20   indicated in the component constitution information section a4.   The sum total of the prices indicated in this section is appropriated as a material cost.

An estimation requester can directly input a component number in the component constitution information section a4.   Further, the

25   estimation requester can call data which was input in the past when

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others conducted estimation.   Furthermore, the estimation requester

can modify the called data and input the modified data.   As

described above, it is arranged that a component number and a suffix

should be stored as identifiers when estimation for a harness is

5 conducted.

Accordingly, when an estimation requester, who knows that

another person has ever conducted estimation for a harness having

the same component number, clicks a reading button a9 in a lower

row of the main screen, the main screen shifts to a predetermined

10 data reading screen.   The estimation requester can call a desired

estimation log and make the log displayed in the component

constitution information section a4, by specifying a component

number and a suffix in this data reading screen.   Due to this, it is

possible to save the labor and time to be cost for the estimation

15 requester to input all of the component number, quantity, unit price,

etc. of the child component constituting the harness.

However, the estimation requester may not use the log.   In this

case, when the estimation requester inputs a component number in

the component number input section a1 and a suffix in the suffix

20 input section a2 and then clicks a component information acquiring

button a5, the control unit 44 automatically acquires the level,

component number, suffix, and quantity of each child component

necessary for manufacturing the harness corresponding to the input

component number, and displays the acquired data in the component

25 constitution information section a4.

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The storage unit 41 of the estimation system 40 stores a
component database.　The component database associates a
component number and suffix which are identifiers of a harness, with
a component number, suffix, level, quantity of each child component
5　necessary for manufacturing the harness.

Accordingly, when the component information acquiring button
a5 is selected, the control unit 44 reads out information on the
corresponding child component from the component database by
using the component number and suffix as keys, and displays the
10　read-out information.　Further, the storage unit 41 stores a unit
component price database in which the component number of each
child component and the unit price of the child component are
associated with each other.　When the estimation requester selects a
unit price information acquiring button a6 in the lower row of the
15　screen, the control unit 44 reads out a unit price that corresponds to
the component number of each child component displayed in the
component constitution information section a4, and displays the
read-out unit price.

However, the unit price can also be directly input by the
20　estimation requester.

The control unit 44 marks the field "kind" in the component
constitution information section a4 with "master" when a unit price is
read out from the unit component price database, and marks the field
with "input" when a unit price is directly input.

25　　　Then, the control unit 44 estimates the material cost of a harness

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based on the quantity and unit price which are read out or directly input to the component constitution information section a4.

As explained above, the estimation system 40 can simplify the estimation requester's work for inputting factors necessary for

5 estimating the material cost, by providing a service that is linked with the component database and the unit component price database.

When the estimation requester clicks a registering button a10 in the lowermost row of the main screen, the information on the child component which is displayed in the component constitution

10 information section a4 at the time the button a10 is clicked is stored as an estimation log.   This estimation log is stored by using the component number and suffix as identifiers.   Therefore, the estimation requester, who calls an estimation log in the past, must click the registering button a10 after changing the suffix in the suffix

15 input section a2 to another one.

The main screen shifts to a processing information screen in response to a click on a process step information editing button a7 arranged under the component constitution information section a4.

The processing information screen is for inputting a calculation

20 factor necessary for estimating a processing cost for each process step.   Process steps include four kinds of process steps, namely, a process step for crimp-connecting, a process step for insulation-displacement-crimping, a process step for wiring preparation works/wiring, and a process step for wiring-related

25 works/continuity check/appearance check.

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FIG. 3 shows a processing information screen for

insulation-displacement-crimping.

The processing information screen has input sections for

inputting calculation factors necessary for calculating a processing

5   cost required in the process step for

insulation-displacement-crimping.   The process step for

insulation-displacement-crimping includes semi-automated

insulation-displacement-crimping (SAIDC) and fully-automated

insulation-displacement-crimping (FAIDC).   The fully-automated

10   insulation-displacement crimping is classified into three kinds,

namely, simple, multi, and copper foil shied.

The processing information screen for

insulation-displacement-crimping will now be specifically explained.

In the processing information screen for

15   insulation-displacement-crimping, input sections for inputting a

number of times for carrying out insulation-displacement-crimping, a

quantity of wires, a quantity of connectors, a number of kinds of

connectors are provided for semi-automated

insulation-displacement-crimping.   In the processing information

20   screen for insulation-displacement-crimping, input sections for

inputting quantities of poles required for respective categories of

wire's largest length are provided for fully-automated

insulation-displacement-crimping (simple).   In the processing

information screen for insulation-displacement-crimping, input

25   sections for inputting quantities of poles required for respective

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categories of wire's largest length are provided for fully-automated

insulation-displacement-crimping (multi).   In the processing

information screen for insulation-displacement-crimping, input

sections for inputting quantities of poles required for respective

5   categories of wire's largest length are provided for fully-automated

insulation-displacement-crimping (copper foil shield).

Further, a navigator display section b1 is provided in the right of

the processing information screen for

insulation-displacement-crimping.

10   FIG. 4 is a diagram showing an example of the navigator display

section b1.

The navigator display section b1 indicates, based on which of

crimp-connecting, insulation-displacement-crimping, wiring

preparation works/wiring, and wiring-related works/continuity

15   check/appearance check, a calculation factor of each process step is

categorized.   Accordingly, the estimation requester can understand

the processing information screen for inputting calculation factors

necessary for manufacturing a harness for which estimation is

requested, at first glance.

20   FIG. 5 shows a processing information screen for

crimp-connecting.   In this screen, input sections for inputting

calculation factors necessary for calculating a processing cost

required in the process step for crimp-connecting.   The process step

for crimp-connecting includes fully-automated cutting, manual

25   crimp-connecting (closed terminal), separate terminal

26

crimp-connecting (resin-covered circle terminal), continuous terminal crimp-connecting, fully-automated dual terminal crimp-connecting (FADTCC), terminal inserting.

In the processing information screen for crimp-connecting, input

5 sections for inputting number of kinds of wire lengths, a quantity of vinyl-covered wires for respective "wire length" categories, and a quantity of other types of wires for respective "wire length" categories are provided for fully-automated cutting.   In this screen, input sections for inputting numbers of points for crimp-connecting

10 for respective "quantity of wires for crimp-connecting" categories are provided for manual crimp-connecting (closed terminal).   In this screen, input sections for inputting number of kinds of terminals, and numbers of points for crimp-connecting for respective "quantity of wires for crimp-connecting" categories are provided for separate

15 terminal crimp-connecting (resin-covered circle terminal).   In this screen, input sections for inputting number of kinds of terminals, and numbers of points for crimp-connecting for respective "quantity of wires for crimp-connecting" categories are provided for continuous terminal crimp-connecting.   In this screen, input sections for

20 inputting number of kinds of wire lengths, and quantities of wires for respective "wire length" categories are provided for fully-automated dual terminal crimp-connecting.   In this screen, input sections for inputting a quantity of connectors and a quantity of terminals are provided for terminal inserting.

25   The navigator display section b1 is also provided in the right of

27

the processing information screen shown in FIG. 5.

FIG. 6 is a processing information screen for wiring preparation works/wiring.   This processing information screen has inputting sections for inputting calculation factors necessary for calculating a

5   processing cost required in the process step for wiring preparation works/wiring.   The wiring preparation works are classified into four categories, namely soldering, insulation sleeve insertion, wire mark adhering, and single connector insertion into housing (hereinafter, a single connector will be referred to as single CN).

10   In the processing information screen for wiring preparation works/wiring, input sections for inputting quantities of wires to which each of an inlet fuse, a micro switch (hereinafter, referred to as micro SW), and a connector is attached, and quantities of components are provided for soldering in wiring preparation works.

15   In this screen, an input section for inputting a number of points for insertion is provided for insulation sleeve insertion in wiring preparation works.   In this screen, input sections for inputting numbers of points to which a wire mark is adhered for respective "quantity of wires" categories (one or two) are provided for wire

20   mark adhering in wiring preparation works.   In this screen, an input section for inputting a quantity of housings is provided for single CN insertion into housing in wiring preparation works.   In this screen, input sections for inputting quantities of connectors and quantities of terminals (for closed terminals, circle terminals, and faston terminals

25   only) for respective "wire's largest length" categories are provided

28

for wiring.

The navigator display section b1 is also provided in the right of the processing information screen shown in FIG. 6.

FIG. 7 shows a processing information screen for wiring-related

5　works/continuity check/appearance check.　In this processing information screen, input sections for inputting calculation factors necessary for calculating a processing cost required in the process step for wiring-related works/continuity check/appearance check are provided.　The wiring-related works are classified into eleven

10　categories, namely, terminal insertion into wires, bind bundling, taping bundling, tube attaching, thermal contraction tube attaching, spiral lap bundling, relay connector attaching, surge killer attaching, circle core attaching, split core attaching, and bracket attaching.

In the processing information screen for wiring-related

15　works/continuity check/appearance check, an input section for inputting a quantity of terminals to be inserted is provided for terminal insertion into wires in wiring-related works.　In this screen, input sections for inputting numbers of points for bind bundling in case of closed terminal/core cross fixing and in case of other methods

20　than cross fixing, are provided for bind bundling in wiring-related works.

In the processing information screen for wiring-related works/continuity check/appearance check, input sections for inputting length of wire, number of branching points, quantity of

25　closed terminals, and number of points for taping for respective

29

"quantity of wires" categories are provided for taping bundling in
wiring-related works.   In this screen, input sections for inputting
tube length and number of points for tube attaching are provided for
tube attaching in wiring-related works.   In this screen, input sections

5   for inputting number of points for tube attaching and tube length in
case of silicon tube and in case of other kinds of tubes than silicon
tube are provided for thermal contraction tube attaching in
wiring-related works.   In this screen, input sections for inputting
wire length, number of points for spiral lap bundling, and number of

10 branching points are provided for spiral lap bundling in
wiring-related works.

In the processing information screen for wiring-related
works/continuity check/appearance check, an input section for
inputting a quantity of relay connectors is provided for relay

15 connector attaching in wiring-related works.   In this screen, an input
section for inputting a quantity of surge killers to be attached is
provided for surge killer attaching in wiring-related works.   In this
screen, input sections for inputting a quantity of cores, a quantity of
wires, and a number of times for winding are provided for circle core

20 attaching in wiring-related works.

In the processing information screen for wiring-related
works/continuity check/appearance check, input sections for
inputting a quantity of cores, and a number of times for winding are
provided for split core attaching in wiring-related works.   In this

25 screen, input sections for inputting a quantity of brackets and a

30

quantity of screws are provided for bracket attaching in

wiring-related works.　In this screen, input sections for inputting a

quantity of connectors and a quantity of terminals (limited to closed,

circle, and faston terminals) are provided for continuity check.　In

5　this screen, input sections for inputting a quantity of connectors and a

quantity of terminals (limited to closed, circle, and faston terminals)

are provided for appearance check.

The navigator display section b1 is also provided in the right of

the processing information screen for wiring-related works/continuity

10　check/appearance check shown in FIG. 7.

The estimation requester inputs values in the input sections

corresponding to the process step which is necessary for

manufacturing a harness for which estimation is requested from a

corresponding one of the above-explained processing information

15　screens.　When a "return" button in the upper right of each

processing information screen is clicked, the processing information

screen returns to the main screen.　Then, by a calculating button a11

in the lowest row of the main screen being clicked, the unit

component price of the harness for which estimation is requested is

20　calculated.

As described above, the unit component price of a harness is

broken down into a material cost, a processing cost, a material loss

cost, a material management cost, a general management cost, a

profit margin, a transportation cost, and transportation/material

25　handling cost.　Estimation functions for individually calculating

31

estimated costs for these costs are stored in the storage unit 41.

Since an operation for calculating the processing cost, among these

costs, is the feature of the present embodiment, the operation for

calculating the processing cost will be explained first with reference

5   to a flowchart shown in FIG. 8.

The estimation requester inputs processing conditions necessary

for estimation from the main screen and the processing information

screen, and clicks the calculating button a11 in the lowest row of the

main screen.   The click on the calculating button a11 triggers the

10   control unit 44 to calculate the operation time in each process step

(S100).   This operation time is a time during which processing

instruments are operated for processing the harness for which

estimation is requested.

In each processing information screen, one can specify

15   calculation factors for each process step such as fully-automated

cutting, manual crimp-connecting, etc., as described above.   On the

other hand, the storage unit 41 stores operation time estimation

functions for the respective process steps in the processing

information screen.   The control unit 44 inputs calculation factors

20   input from the processing information screen into the corresponding

operation time estimation function, and calculates the operation time

for the corresponding process step.   Or, the control unit 44 reads out

an operation time corresponding to the input calculation factors from

a predetermined table in the storage unit 41.

25   How to use the operation time estimation functions stored in the

32

storage unit 41 in correspondence to the respective process steps

explained in the processing information screen, and the table defining

the operation times will now be explained.

[Operation Time Estimation Function for

5 Insulation-Displacement-Crimping]

As shown in FIG. 3, process steps for

insulation-displacement-crimping (IDC) includes semi-automated

insulation-displacement-crimping, fully-automated

insulation-displacement-crimping (simple), fully-automated

10 insulation-displacement-crimping (multi), and fully-automated

insulation-displacement-crimping (copper foil shield).

The control unit 44 calculates the operation time for

semi-automated insulation-displacement-crimping by using an

operation time estimation function indicated by an equation (1)

15 below.

Operation Time = 3.1 × number of times for carrying out IDC +

1.7 × quantity of wires + 1.0 × number of kinds of connectors

---(1)

Values input in the input sections in the "semi-automated

20 insulation-displacement-crimping" category in the processing

information screen shown in FIG. 3 are used as the number of times

for carrying out IDC, quantity of wires, and number of kinds of

connectors in the above estimation function.

The operation time of the fully-automated

25 insulation-displacement-crimping (simple) can be acquired an

operation time table shown in FIG. 9.   This operation time table is
pre-stored in the storage unit 41.   The operation time table shown in
FIG. 9 defines operation times corresponding to the values for the
respective "wire's largest length" categories and the respective

5   "quantity of poles" categories input in the input sections in the
"fully-automated insulation-displacement-crimping (simple)"
category.

The control unit 44 acquires the operation time for
fully-automated insulation-displacement-crimping (multi) from an

10   operation time table shown in FIG. 10.   This operation time table is
pre-stored in the storage unit 41.   The operation time table shown in
FIG. 10 defines operation times corresponding to the values for the
respective "wire's largest length" categories and respective "quantity
of poles" categories input in the input sections in the

15   "fully-automated insulation-displacement-crimping (multi)"
category.

The control unit 44 acquires the operation time for
fully-automated insulation-displacement-crimping (copper foil
shield) from an operation time table shown in FIG. 11.   This

20   operation time table is pre-stored in the storage unit 41.   The
operation time table shown in FIG. 11 defines operation times
corresponding to the values for the respective "wire's largest length"
categories and the respective "quantity of poles" categories input in
the input sections in the "fully-automate

25   insulation-displacement-crimping (copper foil shield)" category.

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[Operation Time Estimation Function for Crimp-Connecting]

As shown in FIG. 5, the process steps for crimp-connecting

include fully-automated cutting, manual crimp-connecting (closed

terminal), separate terminal crimp-connecting (resin-covered circle

5   terminal), continuous-terminal crimp-connecting, fully-automated

dual terminal crimp-connecting, and terminal inserting.

The control unit 44 calculates the operation time for

fully-automated cutting by using an operation time estimation

function read out from a calculation equation table shown in FIG. 12.

10   The calculation equation table is pre-stored in the storage unit 41.

The calculation equation table shown in FIG. 12 defines operation

time estimation functions for the respective "wire length" categories

and the respective "kinds of quantities of wires" categories shown in

FIG. 5.   The operation time is calculated by inputting a value in the

15   input section for "quantity of wires" in FIG. 5 into an operation time

estimation function defined in the calculation equation table shown in

FIG. 12.   Accordingly, the control unit 44 obtains values by

inputting quantities of wires into the respective operation time

estimation functions read out from the calculation equation table

20   shown in FIG. 12, and calculates the operation time by adding up the

obtained values.

The control unit 44 calculates the operation time for manual

crimp-connecting (closed terminal) by using an operation time

estimation function read out from a calculation equation table shown

25   in FIG. 13.   The calculation equation table is pre-stored in the

35

storage unit 41.   The calculation equation table shown in FIG. 13

defines operation time estimation functions for the respective

"quantity of wires for crimp-connecting" categories shown in FIG. 5.

The operation time is calculated by inputting a value in the input

5   section for "number of points" in FIG. 5 into an operation time

estimation function defined in the calculation equation table shown in

FIG. 13.

Accordingly, the control unit 44 obtains values by inputting

numbers of points to which manual crimp-connecting is applied into

10   the respective operation time estimation functions read out form the

calculation equation table shown in FIG. 13, and calculates the

operation time by adding up the obtained values.

The control unit 44 calculates the operation time for separate

terminal crimp-connecting (resin-covered circle terminal) by using an

15   operation time estimation function read out from a calculation

equation table shown in FIG. 14.   This calculation equation table is

pre-stored in the storage unit 41.   The calculation equation table

shown in FIG. 14 defines operation time estimation functions for the

respective "quantity of wires for crimp-connecting" categories shown

20   in FIG. 5.

The operation time is calculated by inputting a value in the input

section for "number of points" in FIG. 5 into an operation time

estimation function defined in the calculation equation table shown in

FIG. 14.   Accordingly, the control unit 44 obtains values by

25   inputting numbers of points to which separate terminal

36

crimp-connecting is applied into the respective operation time

estimation functions read out from the calculation equation table

shown in FIG. 14, and calculates the operation time by adding up the

obtained values.

5   The control unit 44 calculates the operation time for continuous

terminal crimp-connecting by using an operation time estimation

function read out from a calculation equation table shown in FIG. 15.

The calculation equation table is stored in the storage unit 41.   The

calculation equation table shown in FIG. 15 defines operation time

10   estimation functions for the respective "quantity of wires for

crimp-connecting" categories shown in FIG. 5.

        The operation time is calculated by inputting a value in the input

section for "number of points" in FIG. 5 into an operation time

estimation function defined in the calculation equation table shown in

15   FIG. 15.   Accordingly, the control unit 44 obtains values by

inputting numbers of points to which continuous terminal

crimp-connecting is applied into the respective operation time

estimation functions read out from the calculation equation table

shown in FIG. 15, and calculates the operation time by adding up the

20   obtained values.

        The control unit 44 calculates the operation time for

fully-automated dual terminal crimp-connecting by using an

operation time estimation function read out from a calculation

equation table shown in FIG. 16.   The calculation equation table is

25   pre-stored in the storage unit 41.   The calculation equation table

37

shown in FIG. 16 defines operation time estimation functions for the respective "wire length" categories shown in FIG. 5.   The operation time is calculated by inputting a value in the input section for "quantity of wires" in FIG. 5 into an operation time estimation

5 function defined in the calculation equation table shown in FIG. 16. Accordingly, the control unit 44 obtains values by inputting quantities of wires in the respective operation time estimation functions read out from the calculation equation table shown in FIG. 16, and calculates the operation time by adding up the obtained

10 values.

The control unit 44 calculates the operation time for terminal inserting by using an estimation function indicated by an equation (2) below.

Operation Time = 2.9 × quantity of connectors + 2.5 ×

15 quantity of terminals   ---(2)

The control unit 44 uses values input in the input sections for the "terminal inserting" category in FIG. 5, as quantity of connectors and quantity of terminals in the above estimation function (2).

[Operation Time Estimation Function for Wiring Preparation

20 Works/Wiring]

As shown in FIG. 6, the process steps for wiring preparation works/wiring includes soldering, insulation sleeve insertion, wire mark adhering, single CN insertion into housing, and wiring.

The control unit 44 calculates the operation time for soldering in

25 the wiring preparation works by using an operation time estimation

38

function read out from a calculation equation table shown in FIG. 17. The calculation equation table is pre-stored in the storage unit 41. The calculation equation table shown in FIG. 17 defines operation time estimation functions for the respective kinds of works (inlet fuse,

5   micro SW, connector) shown in FIG. 6.   The operation time is calculated by inputting values in the input sections for "quantity of wires" and "quantity of components" in FIG. 6 into an operation time estimation function defined in the calculation equation table shown in FIG. 17.

10   Accordingly, the control unit 44 obtains values by inputting quantities of wires and quantities of components to which soldering is applied into the respective operation time estimation functions read out from the calculation equation table shown in FIG. 17, and calculates the operation time by adding up the obtained values.

15   The control unit 44 calculates the operation time for insulation sleeve insertion in the wiring preparation works by using an operation time estimation function indicated by an equation (3) below.

         Operation Time = 90 × number of points to which sleeve is
20   inserted   ---(3)

         The control unit 44 uses a value input in the input section for "number of points for insulation sleeve insertion" in FIG. 6, as number of points to which a sleeve is inserted in the above equation (3).

25   The control unit 44 calculates the operation time for wire mark

39

adhering in the wiring preparation works by using an operation time

estimation function read out from a calculation equation table shown

in FIG. 18.　The calculation equation table is pre-stored in the

storage unit 41.　The calculation equation table shown in FIG. 18

5　defines operation time estimation functions for the respective

"quantity of wires" categories (1, and 2 or more) shown in FIG. 6.

The operation time is calculated by inputting a value in the input

section for "number of points to which a wire mark is adhered" in

FIG. 6 into an operation time estimation function defined in the

10　calculation equation table shown in FIG. 18.　Accordingly, the

control unit 44 obtains values by inputting numbers of points to

which a wire mark is adhered into the respective operation time

estimation functions read out from the calculation equation table

shown in FIG. 18, and calculates the operation time by adding up the

15　obtained values.

The control unit 44 calculates the operation time for single CN

insertion into housing in the wiring preparation works by using an

estimation function indicated by an equation (4) below.

Operation Time = 1.0 + 9.0 × quantity of housings　　---(4)

20　A value input in the input section for "quantity of housings" in

FIG. 6 is used as quantity of housings in the above equation (4).

The control unit 44 calculates the operation time for wiring by

using an operation time estimation function read out from a

calculation equation table shown in FIG. 19.　The calculation

25　equation table is pre-stored in the storage unit 41.　The calculation

40

equation table shown in FIG. 19 defines operation time estimation

functions for the respective "wire's largest length" categories shown

in FIG. 6.   The operation time is calculated by inputting values in

the input sections for "quantity of connectors" and "quantity of

5   terminals" in FIG. 6 into an operation time estimation function

defined in the calculation equation table shown in FIG. 19.

Accordingly, the control unit 44 calculates the operation time for

wiring by inputting quantities of connectors and quantities of

terminals into the respective operation time estimation functions read

10 out from the calculation equation table shown in FIG. 19.

[Operation Time Estimation Function for Wiring-Related

works/continuity check/appearance check]

As shown in FIG. 7, the process steps for wiring-related

works/continuity check/appearance check include terminal insertion

15 into wires, bind bundling, taping bundling, tube attaching, thermal

contraction tube attaching, spiral lap bundling, relay connector

attaching, surge killer attaching, circle core attaching, split core

attaching, bracket core attaching, and continuity check and

appearance check.

20   The control unit 44 calculates the operation time for terminal

insertion into wires by using an estimation function indicated by an

equation (5) below.

Operation Time = 2.9 + 3.9 × quantity of terminal to be inserted

---(5)

25   A value input in the input section for "quantity of terminals to be

41

inserted" in FIG. 7 is used as quantity of terminals to be inserted in the estimation function indicated by the equation (5).

The control unit 44 calculates the operation time for bind bundling by using an operation time estimation function read out

5 from a calculation equation table shown in FIG. 20.   This calculation equation table is pre-stored in the storage unit 41.   The calculation equation table 20 defines operation time estimation functions for the respective "kind of bind" categories (80, 100, 150, closed terminal, core cross fixing) shown in FIG. 7.   The operation

10 time is calculated by inputting a value in the input section for "number of points for bind" in FIG. 7 into an operation time estimation function defined in the calculation equation table shown in FIG. 20.

Accordingly, the control unit 44 calculates the operation time for

15 bind bundling by inputting numbers of points for bind into the respective operation time estimation functions read out from the calculation equation table shown in FIG. 20.

The control unit 44 calculates the operation time for taping bundling by using an operation time estimation function read out

20 from a calculation equation table shown in FIG. 21.   The calculation equation table is pre-stored in the storage unit 41.   The calculation equation table shown in FIG. 21 defines operation time estimation functions for the respective "quantity of wires" categories (3 or less, 4 to 10, 11 or less) shown in FIG. 7.

25   The operation time is calculated by inputting values in the input

42

sections for "length", "number of branching points", "quantity of closed terminals", and "number of points for taping" into an operation time estimation function defined in the calculation equation table shown in FIG. 21. Accordingly, the control unit 44 calculates

5　the operation time for taping bundling by inputting lengths, numbers of branching points, quantities of closed terminals, and numbers of points for taping into the respective operation time estimation functions read out from the calculation equation table shown in FIG. 21.

10　　　　The control unit 44 calculates the operation time for tube attaching by using an estimation function indicated by an equation (6) below.

Operation Time = 0.7 + 6.5 × number of points for attaching a tube + 0.01 × tube length　---(6)

15　　　　A value input in the input section for "number of points" to which a tube is attached in FIG. 7 is used as number of points for attaching a tube in the estimation function indicated by the equation (6). A value input in the input section for "tube length" in FIG. 7 is used as tube length in the above estimation function.

20　　　　The control unit 44 calculates the operation time for thermal contraction tube attaching by using an operation time estimation function read out from a calculation equation table shown in FIG. 22. The calculation equation table is pre-stored in the storage unit 41. The calculation equation table shown in FIG. 22 defines operation

25　time estimation functions for the respective "tube kind" categories

43

(silicon tube and other kinds of tubes) shown in FIG. 7.   The

operation time is calculated by inputting values in the input sections

for "number of points" and "tube length" in FIG. 7 into an operation

time estimation function defined in the calculation equation table

5   shown in FIG. 22.   Accordingly, the control unit 44 calculates the

operation time by inputting numbers of points and tube lengths into

the respective operation time estimation functions read out from the

calculation equation table shown in FIG. 22.

The control unit 44 calculates the operation time for spiral lap

10   bundling by using an operation time estimation function indicated by

an equation (7) below.

Operation Time = 0.3 + 1.0 × number of points for spiral lap

bundling + 0.3 × wire length + 3.6 × number of branching points

---(7)

15   A value input in the input section for "number of points" to

which spiral lap bundling is applied in FIG. 7 is used as number of

points for spiral lap bundling in the above estimation function

indicated by the equation (7).   A value input in the input section for

"wire length" in FIG. 7 is used as wire length in the above estimation

20   function.   A value input in the input section for "number of

branching points" in FIG. 7 is used as number of branching points in

the above estimation function.

The control unit 44 calculates the operation time for relay

connector attaching by using an estimation function indicated by an

25   equation (8) below.

44

Operation Time = 1.0 + 1.8 × quantity of relay connectors ---(8)

A value input in the input section for "quantity" of relay connectors in FIG. 7 is used as quantity of relay connectors in the

5　　equation (8).

The control unit 44 calculates the operation time for surge killer attaching by using an estimation function indicated by an equation (9) below.

Operation Time = 1.0 + 21.5 × quantity of surge killers　---(9)

10　　A value input in the input section for "quantity" of surge killers in FIG. 7 is used as quantity of surge killers in the equation (9).

The control unit 44 calculates the operation time for circle core attaching by using an estimation function indicated by an equation (10) below.

15　　Operation Time = 0.3 + 1.0 × quantity of wires + 3.6 × number of times for winding + 1.0 × quantity of cores　　---(10)

A value input in the input section for "quantity of wires" in FIG. 7 is used as quantity of wires in the equation (10).　A value input in the input section for "number of times for winding" in FIG. 7 is used

20　　as number of time for winding in the equation (10).　A value input in the input section for "quantity of cores" in FIG. 7 is used as number of cores in the equation (10).

The control unit 44 calculates the operation time for split core attaching by using an estimation function indicated by an equation

25　　(11) below.

45

Operation Time = 1.0 + 1.8 × quantity of cores + 1.8 ×

number of times for winding   ---(11)

A value input in the input section for "quantity of cores" in FIG.

7 is used as quantity of cores in the equation (11).   A value input in

5 the input section for "number of times for winding" in FIG. 7 is used

as number of times for winding in the equation (11).

The control unit 44 calculates the operation time for bracket

attaching by using an estimation function indicated by an equation

(12) below.

10   Operation Time = 1.0 + 8.7 × quantity of brackets + 8.7 ×

quantity of screws   ---(12)

A value input in the input section for "quantity of brackets" in

FIG. 7 is used as quantity of brackets in the equation (12).   A value

input.in the input section for "quantity of screws" in FIG. 7 is used as

15 quantity of screws in the equation (12).

The control unit 44 calculates the operation time for continuity

check by using an estimation function indicated by an equation (13)

below.

Operation Time = 3.2 + 3.2 × (quantity of connectors +

20 quantity of terminals)   ---(13)

A value input in the input section for "quantity of connectors" in

FIG. 7 is used as quantity of connectors in the equation (13).   A

value in the input section for "quantity of terminals" in FIG. 7 is used

as quantity of terminals in the equation (13).

25   The control unit 44 calculates the operation time for appearance

46

check by using an estimation function indicated by an equation (14) below.

Operation Time = 1.5 × (quantity of connectors + quantity of terminals)   ---(14)

5   A value input in the input section for "quantity of connectors" in FIG. 7 is used as quantity of connectors in the equation (14).   A value input in the input section for "quantity of terminals" in FIG. 7 is used as quantity of terminals in the equation (14).

Explanation will now return to FIG. 8.

10   The control unit 44, which has calculated the operation time of each process step (S100), then calculates an instrument-proportional common cost (IPC cost) in each process step (S200).   The instrument-proportional common cost is a material cost arising from operation of harness processing instruments.   The control unit 44

15   calculates the instrument-proportional common cost by using an operation cost estimation function indicated by an equation (15) below.

IPC cost = net operation time × time factor × IPC cost ratio ---(15)

20   This operation cost estimation function indicated by the equation (15) will now be explained in more detail.   The operation time is the operation time calculated for each process step.   The time factor is acquired from a time factor setting table which is pre-stored in the storage unit 41.

25   FIG. 23 shows the contents of the time factor setting table.   The

47

time factor setting table associates the process steps shown in FIG. 3,

FIG. 5, FIG. 6 and FIG. 7 with corresponding time factors.   The

instrument-proportional common cost ratio (IPC cost ratio) is

acquired from a processing cost ratio master table which is pre-stored

5   in the storage unit 41.

FIG. 24 shows the contents of the processing cost ratio master

table.   The processing cost ratio master table associates the process

steps shown in FIG. 3, FIG. 5, FIG. 6, and FIG. 7 with corresponding

instrument-proportional common cost ratios and corresponding

10   labor-proportional common cost ratios (LPC cost ratios).   The

instrument-proportional common cost ratio is a ratio of a cost

commonly required in proportion to the kinds of instruments.   The

labor-proportional common cost ratio is a ratio of a cost commonly

required in proportion to the kinds of labors.

15   Accordingly, the control unit 44 calculates the

instrument-proportional common cost for each process step by

inputting the calculated operation time, a time factor read out from

the time factor setting table, and an instrument-proportional common

cost ratio read out from the processing cost ratio master table shown

20   in FIG. 24 into the operation cost estimation function read out from

the storage unit 41.

In addition to the instrument-proportional common cost ratio per

hour and the labor-proportional common cost ratio per hour, the

processing cost ratio master table shown in FIG. 24 defines ratios

25   obtained by converting these ratios into ratios per second.   The

control unit 44 makes calculations by using the
instrument-proportional common cost ratio per second and the
labor-proportional common cost ratio per second.

The control unit 44, which has calculated the

5   instrument-proportional common cost, calculates a work time in each
process step (S300).   The work time is calculated by using a work
time estimation function indicated by an equation (16) below.

Work Time = Operation time / number of working members
---(16)

10   This work time estimation function will now be explained in
more detail.

The operation time is the operation time calculated for each
process step.   The number of working members is the number of
harness processing instruments handled by one working member, and

15   is pre-set for each process step.   For example, the number of
working members is set to 2 for fully-automated dual terminal
crimp-connecting, 1.5 for fully-automated dual terminal
insulation-displacement-crimping (FADTIDC), and 1 for the rest of
the process steps.   This means that two fully-automated dual

20   terminal crimp-connecting (FADTCC) machines should be handled
by one member, and three fully-automated dual terminal
insulation-displacement-crimping (FADTIDC) machines should be
handled by two members.

The control unit 44, which has calculated the work time,

25   calculates a labor-proportional common cost (LPC cost) for each

49

process step (S400).　The labor-proportional common cost is a labor

cost arising from operation of harness processing instruments.　The

control unit 44 calculates the labor-proportional common cost by

using an operation cost estimation function indicated by an equation

5　(17) below.

LPC cost = net work time × time factor × LPC cost ratio

---(17)

The operation cost estimation function (labor-proportional

common cost estimation function) will now be explained in more

10　detail.　The work time is the work time calculated for each process

step.　The time factor is acquired from the time factor setting table

shown in FIG. 23.　The labor-proportional common cost ratio is

acquired from the processing cost ratio master table shown in FIG.

24.

15　　　The control unit 44, which has calculated the labor-proportional

common cost, calculates a planning time for each process step (S500).

As described above, calculation factors for each process step such as

fully-automated cutting and manual crimp-connecting, etc. are input

from the processing information screen.

20　　　On the other hand, the storage unit 41 stores planning time

estimation functions for the respective process steps in the processing

information screen.　The control unit 44 reads out a planning time

estimation function for a process step for which calculation factors

are input from the processing information screen, from the storage

25　unit 41.　The control unit 44 inputs the input calculation factors and

50

calculation factors read out from a predetermined table in the storage

unit 41 into the planning time estimation function, and calculates the

planning time for the process step.

However, note that some process steps do not need a planning

5   work.   The control unit 44 sets the planning time for process steps

that do not need a planning work, as 0.

The specific content of the planning time estimation function

stored in the storage unit 41 in association with each process step

shown in the processing information screen will now be explained.

10   [Planning Time Estimation Function for

Insulation-Displacement-Crimping]

As shown in FIG. 3, the process steps relating to

insulation-displacement-crimping include semi-automated

insulation-displacement-crimping, fully-automated

15   insulation-displacement-crimping (simple), fully-automated

insulation-displacement-crimping (multi), and fully-automated

insulation-displacement-crimping (copper foil shield).

The control unit 44 calculates the planning time for

semi-automated insulation-displacement-crimping by using a

20   planning time estimation function indicated by an equation (18)

below.

Planning Time = 90 × number of kinds of connectors

---(18)

A value input in the input section for "number of kinds of

25   connectors" in FIG. 3 is used as number of kinds of connectors in the

51

above equation (18).

The control unit 44 calculates the planning time for fully-automated insulation-displacement-crimping (simple) by using a planning time estimation function indicated by an equation (19)

5 below.

Planning Time = 35 × number of kinds of wire lengths

---(19)

Number of kinds of wire lengths in the above equation (19) is the total number of categories in which quantity of poles is input,

10 among the four categories of "wire's largest length" shown in FIG. 3.

The control unit 44 calculates the planning time for fully-automated insulation-displacement-crimping (multi) by using a planning time estimation function indicated by an equation (20) below.

15 Planning Time = 50 × number of kinds of wire lengths

---(20)

Number of kinds of wire lengths in the above equation (20) is the total number of categories in which quantity of poles is input, among the four categories of "wire's largest length" shown in FIG. 3.

20 The control unit 44 calculates the planning time for fully-automated insulation-displacement-crimping (copper foil shield) by using a planning time estimation function indicated by an equation (21) below.

Planning Time = 40 × number of kinds of wire lengths

25 ---(21)

52

Number of kinds of wire lengths in the above equation (21) is

the total number of categories in which quantity of poles is input,

among the four categories of wire's largest length shown in FIG. 3.

[Planning Time Estimation Function for Crimp-Connecting]

5　　　As shown in FIG. 5, the process steps relating to

crimp-connecting include fully-automated cutting, manual

crimp-connecting (closed terminal), separate terminal

crimp-connecting (resin-covered circle terminal), continuous terminal

crimp-connecting, fully-automated dual terminal crimp-connecting,

10　and terminal inserting.

The control terminal 4 calculates the planning time for

fully-automated cutting by using a planning time estimation function

indicated by an equation (22) below.

Planning Time = 30 × number of kinds of wire lengths

15　---(22)

A value input in the input section for "number of kinds of wire

lengths" in FIG. 5 is used as number of kinds of wire lengths in the

above equation (22).　Since the process step for manual

crimp-connecting does not need a planning work, the control unit 44

20　sets the planning time for this process step as 0.

The control unit 44 calculates the planning time for separate

terminal crimp-connecting (resin-covered circle terminal) by using a

planning time estimation function indicated by an equation (23)

below.

25　　　Planning Time = 60 × number of kinds of terminals　---(23)

53

A value input in the input section for "number of kinds of
terminals" in Fig. 5 is used as number of kinds of terminals in the
above equation (23).

The control unit 44 calculates the planning time for continuous
5   terminal crimp-connecting by using a planning time estimation
function indicated by an equation (24) below.

Planning Time = 55 × number of kinds of terminals   ---(24)

A value input in the input section for "number of kinds of
terminals" in FIG. 5 is used as number of kinds of terminals in the
10   above equation (24).

The control unit 44 calculates the planning time for
fully-automated dual terminal crimp-connecting by using a planning
time estimation function indicated by an equation (25) below.

Planning Time = 70 × number of kinds of wire lengths

15   ---(25)

A value input in the input section for "number of kinds of wire
lengths" in FIG. 5 is used as number of kinds of wire lengths in the
above equation (25).

Since the process step for terminal inserting does not need a
20   planning work, the control unit 44 sets the planning time for this
process step as 0.

[Planning Time Estimation Function for Wiring Preparation
Works/Wiring]

As shown in FIG. 6, the process steps relating to wiring
25   preparation works/wiring include soldering, insulation sleeve

54

insertion, wire mark adhering, single CN insertion into housing, and wiring.   Since all of these process steps do not need a planning work, the control unit 44 sets the planning time for these process steps as 0.

[Planning Time Estimation Function for Wiring-Related

5   Works/Continuity Check/Appearance Check]

As shown in FIG. 7, the process steps relating to wiring-related works/continuity check/appearance check include terminal insertion into wires, bind bundling, taping bundling, tube attaching, thermal contraction tube attaching, spiral lap bundling, relay connector

10   attaching, surge killer attaching, circle core attaching, split core attaching, bracket attaching, and continuity check and appearance check.   Since all of these process steps do not need a planning work, the control unit 44 sets the planning time for these process steps as 0.

Explanation will now return to FIG. 8.

15   The control unit 44, which has calculated the planning time, calculates a planning cost for each process step (S600).

The planning cost includes a material cost and a labor cost arising in the preparation stage before operating harness processing instruments.   The control unit 44 calculates the planning cost by

20   using a planning cost estimation function indicated by an equation (26) below.

Planning Cost = (net planning time/working lot) × time factor × (IPC cost ratio + LPC cost ratio)   ---(26)

This planning cost estimation function will now be explained

25   more specifically.   Planning time in the equation (26) is the

55

planning time calculated for each process step.   Time factor is
pre-set to 1.13.   IPC cost ratio and LPC cost ratio are acquired from
the processing cost ratio master table shown in FIG. 24.

   The control unit 44, which has calculated the planning cost,

5   calculates the processing cost for each process step by adding up the
instrument-proportional common cost, the labor-proportional
common cost, and the planning cost of each process step which have
been calculated (step S700).   The processing cost of each process
step is displayed on a later-described processing cost display screen.

10   Further, the control unit 44 calculates the total of the processing
costs by adding up the processing costs of all of the process steps
(step S800).   This total processing cost is displayed on a
later-described unit component price screen and on the processing
cost display screen.

15   Thus, the calculation of the processing cost shown in FIG. 8 is
completed.

   The control unit 44 calculates the other costs such as the
material cost, the material loss cost, the material management cost,
the general management cost, the profit margin, and the

20   transportation/material handling cost, by using estimation functions
read out from the storage unit 41, likewise the processing cost
explained above.   A detailed explanation of how to calculate these
costs will be omitted.

   When the estimation requester clicks an estimation result list

25   display button a8 in the main screen shown in FIG. 2, the control unit

56

44 displays the calculation results on the output unit 43, as an

estimated cost list screen.

The estimated cost list screen is constituted by a unit component

price screen displaying the unit component price, and its breakdown

5   including the material cost, the processing cost, the material loss cost,

the material management cost, the general management cost, the

profit margin, and the transportation/material handling cost, and by a

processing cost display screen displaying the processing cost of each

process step.

10   The control unit 44 first displays the unit component price

screen shown in FIG. 25.   The unit component price screen displays

the unit component price, the material cost, the processing cost, the

material loss cost, the material management cost, the general

management cost, the profit margin, and the transportation/material

15   handling cost.

Next, the control unit 44 displays the processing cost display

screen shown in FIG. 26.   The processing cost display screen

displays the planning cost, the planning time, the

instrument-proportional common cost, the work time, and the

20   labor-proportional common cost, which are calculated in the process

of calculating the processing cost, and the processing cost obtained

by adding up all of these, process step by process step.

According to the present embodiment described above, the

estimation system 40 receives input of calculation factors necessary

25   for calculating the processing cost of a harness from the estimation

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requester, and calculates the unit component price of the harness by

using the input calculation factors and pre-stored estimation functions.

Accordingly, a designer of a harness can design the harness by taking

the unit component price of the harness that is required for

5　manufacturing the harness, into consideration.

The processing cost of a harness is made up of an

instrument-proportional common cost calculated based on an

operation time, a labor-proportional common cost calculated based

on a work time, and a planning cost calculated based on a planning

10　time.　According to the present embodiment, the work time, the

instrument-proportional common cost, the work time, the

labor-proportional common cost, the planning time, and the planning

cost, which are calculated in the process of calculating the processing

cost can be displayed process step by process step.　Because of this,

15　the designer of a harness can easily grasp the breakdown of the

processing cost of each process step and the time required for

processing.　This makes it possible for a person who needs to know

the estimated cost in a business negotiation, a person who makes the

process step plan, a person who plans staff member allocation, etc. to

20　refer to the unit component price of a harness and the state of how

busy it is in each process step, and to perform their own duties

efficiently.

[Example 1]

A detailed example according to the above-described

25　embodiment will now be explained.　In the above-described

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embodiment, when values are input in the input sections for inputting

calculation factors which are provided on the processing information

screen, an estimation function of a corresponding process step is read

out and the processing cost of the process step for which calculation

5 factors have been input, is calculated by using the read-out estimation

function.

However, according to such a calculation process, subjective

opinions of the estimation requester must be relied upon in order to

determine what process steps must be undergone to manufacture a

10 harness for which estimation is requested, in other words, for what

process steps the estimation requester must input calculation factors.

Accordingly, the present example will describe a structure in which

an inexperienced estimation requester who can not figure out the

process steps necessary to manufacture a harness from a diagram

15 showing the harness's completed state, can also be helped as to what

calculation factors must be input for estimation.

In the present embodiment, a redisplayed version of the

processing information screen will be output, which displays process

steps (referred to as required process steps) for which calculation

20 factors must be input without fail in a case where a harness is to be

manufactured based on conditions which the estimation requester

inputs from a process step setting screen displayed by clicking a

process step setting guide button provided in the upper right of the

processing information screen shown in FIG. 3, FIG. 5, FIG. 6, and

25 FIG. 7, and process steps (referred to as drawing-specified process

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steps) for which calculation factors must be input in a case where the

process steps are specified by a drawing depicting the harness for

which estimation is requested, both types of process steps in different

colors.

5   First, the process step setting screen displayed by clicking the

process step setting guide button will be explained.

The process step setting screen includes an

insulation-displacement-crimping step setting screen and a

crimp-connecting step setting screen.   If a component number of a

10 child component displayed in the component constitution information

section a4 in the main screen shown in FIG. 2 includes, for example,

"1100****", this means that a crimp-connecting machine will be

used in the process step.   In this case, conditions need to be input

from the crimp-connecting step setting screen.   On the other hand, if

15 a displayed component number of a child component does not

include "1100***", this means that an

insulation-displacement-crimping (IDC) machine will be used in the

process step.   In this case, conditions need to be input from the

crimp-connecting step setting screen.

20   FIG. 27 shows the insulation-displacement crimping step setting

screen.   In a lower row of this screen, there is provided an input

section for inputting wire length for

insulation-displacement-crimping (simple).   At the right of this

input section, there is displayed a reference diagram of

25 insulation-displacement-crimping (simple).   Further, in a case where

60

a conducting wire to be used is a copper foil shield wire, a check box
is provided under the wire length input section, so that the estimation
requester clicks the box.

Furthermore, in a case where the quantity of unused pins of a
5 connector is equal to or larger than the half of the total quantity of
pins of this connector, a check box is further provided under the
above check box, so that the estimation requester clicks it.   In the
middle to lower rows of the screen, there are provided input sections
for inputting wire lengths for respective harness units that need
10 insulation-displacement-crimping (multi).   At the right of these
input sections, there is displayed a reference diagram of
insulation-displacement-crimping (multi).   In a case where there are
two or more continuous pins that are unused in a parent connector,
there is provided a check box above the wire length input sections so
15 that the estimation requester checks the check box.

FIG. 28 shows the crimp-connecting step setting screen.· In this
screen, there are provided input sections for inputting wire lengths of
respective harness units.   Further, in a case where there are
conditions such as that any terminal is a closed terminal, or a
20 resin-covered circle terminal, or has a micro SW, an inlet, a fuse
holder, or a first-in sleeve, there are provided check boxes so that the
estimation requester checks corresponding ones.   Furthermore, in a
case where the material of wires of each harness is any of silicon,
glass, and Teflon (R), there is provided a check box under the wire
25 length input section so that the estimation requester checks the check

box.

The estimation requester, who has input necessary conditions from the insulation-displacement-crimping step setting screen and the crimp-connecting step setting screen, clicks an OK button provided

5   in the upper right of the screen.   Due to this, selection of required process steps and drawing-specified process steps will be started. The control unit 44 first selects an insulation-displacement-crimping machine or a crimp-connecting machine that is necessary for processing a harness by performing an

10   insulation-displacement-crimping machine selection operation or a crimp-connecting machine selection operation.   This is because required process steps and drawing-specified process steps are set in correspondence with the kinds of insulation-displacement-crimping machines or crimp-connecting machines, as will be described later.

15   FIG. 29 shows a flowchart of the insulation-displacement-crimping machine selection operation.   In a case where a component number of a child component displayed in the component constitution information section a4 in the main screen includes "1100****", this insulation-displacement-crimping machine

20   selection operation is performed.

First, the control unit 44 determines whether or not the wire length input in the wire length input section in the insulation-displacement-crimping step setting screen is within a pre-set range (S11).   That is, the control unit 44 determines whether

25   or not the input wire length is equal to or greater than 500 mm and

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equal to or smaller than 1000 mm in case of multi, and whether or
not the input wire length is equal to or greater than 100 mm and equal
to or smaller than 2000 mm in case of simple. In a case where
determining that the input wire length is out of this range, the control

5 unit 44 selects a semi-automated insulation-displacement-crimping
machine.

In a case where determining that the input wire length is within
the range, the control unit 44 determines whether or not the lot
number input in the monthly lot input section a3 in the main screen is

10 equal to or greater than 200 (S12). In a case where determining that
the lot number is smaller than 200, the control unit 44 selects a
semi-automated insulation-displacement-crimping machine.

In a case where determining that the lot number is equal to or
greater than 200, the control unit 44 determines whether or not the

15 number of kinds of connectors is equal to or smaller than 4 kinds
(S13). In case of insulation-displacement-crimping (simple), if the
component number of the parent component and the component
number of the child component are different, the number of kinds of
connectors is counted as 2. In case of

20 insulation-displacement-crimping (multi), the number of kinds of
connectors is the total of the numbers of pairs of parent components
and child components that have different component numbers from
each other. Then, in a case where determining that the number of
kinds of connectors is equal to or greater than 4, the control unit 44

25 selects a semi-automated insulation-displacement-crimping machine.

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In a case where determining that the number of kinds of
connector is equal to or smaller than 4, the control unit 44 determines
whether or not the state of unused pins satisfies a pre-set condition
(S14).   That is, the control unit 44 determines whether or not the

5   check box for the condition that the quantity of unused pins in one
connector is half or more of the total quantity of pins is clicked in
case of simple, and determines whether or not the check box for the
condition that the there are two or more continuous unused pins in
the parent connector is clicked in case of multi.   Then, in a case

10   where determining that this condition is satisfied, the control unit 44
selects a semi-automated insulation-displacement-crimping machine.

In a case where determining that the state of unused pins doesn't
satisfy the above condition, the control unit 44 selects a
fully-automated insulation-displacement-crimping machine.   The

15   fully-automated insulation-displacement-crimping machine includes
three types, namely "simple", "multi", and "copper foil shield".
The control unit 44 selects the "simple" type
insulation-displacement-crimping machine in a case where the wire
length is input in the wire length input section for simple in the

20   insulation-displacement-crimping step setting screen.   The control
unit 44 selects the "multi" type insulation-displacement-crimping
machine in a case where the wire length is input in the wire length
input section for multi.   The control unit 44 selects the "copper foil
shield" type insulation-displacement-crimping machine in a case

25   where the check box for copper foil shield wire is clicked in the

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insulation-displacement-crimping step setting screen.

Thus, the insulation-displacement-crimping machine selection operation shown in FIG. 29 is completed.

FIG. 30 shows a flowchart of the crimp-connecting machine
5　selection operation.

The control unit 44 performs this operation in a case where a component number of a child component displayed in the component constitution information section a4 in the main screen does not include "1100****".

10　First, the control unit 44 determines whether or not the wire length input in the wire length input section in the crimp-connecting step setting screen is within a pre-set range (S21). That is, the control unit 44 determines whether or not the wire length is equal to or greater than 100 mm and equal to or smaller than 1000 mm.

15　In a case where determining that the input wire length is not within the range, the control unit 44 determines whether or not the wire length input in the wire length input section is within another pre-set range (S22). That is, the control unit 44 determines whether or not the wire length is equal to or greater than 10 mm and smaller
20　than 100 mm, or greater than 1000 mm and equal to or smaller than 5000 mm.

In a case where determining that the wire length is within the another pre-set range, the control unit 44 selects a semi-automated crimp-connecting (SACC) machine. On the contrary, in a case
25　where determining that the wire length is not within the another

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pre-set range either, the control unit 44 selects neither required process steps nor drawing-specified process steps, by determining that there is no corresponding crimp-connecting machine.

Returning to step S21, in a case where the wire length input in

5   the wire length input section is in the range of equal to or greater than 100 mm and equal to or smaller than 1000 mm, the control unit 44 determines whether or not the kind of terminal is a resin-covered circle terminal (S23).   In a case where determining that the kind of terminal is a resin-covered circle terminal, the control unit 44 selects

10   a hand crimp-connecting machine.

In a case where determining that the kind of terminal is not a resin-covered circle terminal, the control unit 44 determines whether or not the kind of terminal is a closed terminal (S24).   In a case where determining that the kind of terminal is a closed terminal, the

15   control unit 44 selects a hand crimp-connecting machine.

In a case where determining that the kind of terminal is not a closed terminal, the control unit 44 determines whether or not the lot number input in the monthly lot input section a3 in the main screen is equal to or greater than 50 (S25).   In a case where determining that

20   the lot number is smaller than 50, the control unit 44 selects a semi-automated crimp-connecting machine.

In a case where determining that the lot number is equal to or greater than 50, the control unit 44 determines whether or not the wire material is any of silicon, glass, and Teflon (R) (S26).   Under

25   the wire length input section in the crimp-connecting step setting

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screen, there is provided a check box for the case where the wire

material is any of silicon, glass, and Teflon (R).　In a case where the

wire material is any of silicon, glass, and Teflon (R) by checking the

state of the check box, the control unit 44 selects a semi-automated

5　crimp-connecting machine.

In a case where determining that the wire material is not silicon,

glass, or Teflon (R), the control unit 44 determines whether there is a

first-in sleeve (S27).　In a case where determining that there is a

first-in sleeve, the control unit 44 selects a semi-automated

10　crimp-connecting machine.

In a case where determining that there is no first-in sleeve, the

control unit 44 determines whether or not there is a power block

connector (S28).　For example, a component number "11001315" is

assigned to a power block connector.

15　Accordingly, in a case where the component number of any

child component displayed in the component constitution information

section a4 in the main screen includes "11001315", the control unit

44 determines that there is a power block connector.　Then, the

control unit 44 selects a semi-automated crimp-connecting machine

20　in a case where there is a power block connector, and selects a

fully-automated crimp-connecting (FACC) machine in a case where

there is no power block connector.

Thus, the crimp-connecting machine selection operation shown

in FIG. 30 is completed.

25　The control unit 44, which has selected an

insulation-displacement-crimping machine or a crimp-connecting

machine to be used for processing the harness by performing the

insulation-displacement-crimping machine selection operation or the

crimp-connecting machine selection operation, reads out required

5　process steps and drawing-specified process steps corresponding to

the selected insulation-displacement-crimping machine or the

selected crimp-connecting machine, from a process step setting table

pre-stored in the storage unit 41.

　　　FIG. 31 and FIG. 32 show the contents of the process step

10　setting table.　The process step setting table defines required process

steps and drawing-specified process steps needed when processing a

harness by using each insulation-displacement-crimping machine or

each crimp-connecting machine.　The steps marked with a double

circle in the process step setting table are required process steps, and

15　the steps marked with a circle in the table are drawing-specified

process steps.　The control unit 44 reads out required process steps

and drawing-specified process steps corresponding to the

insulation-displacement-crimping machine or the crimp-connecting

machine selected by the insulation-displacement-crimping machine

20　selection operation or by the crimp-connecting machine selection

operation, from this table.

　　　The process step setting table defines required process steps and

drawing-specified process steps by categorizing hand

crimp-connecting machines into two categories and categorizing

25　semi-automated crimp-connecting machines into five categories.

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The control unit 44 determines from which categories a required

process step and a drawing-specified process step are to be read out,

based on check marks in the crimp-connecting step setting screen.

For example, the process step setting table defines the field of hand

5　crimp-connecting machines by categorizing the machines into two

categories, namely closed terminal and resin-covered circle terminal.

In a case where the check box for "closed terminal included" is

selected in the crimp-connecting step setting screen, the control unit

44 reads out a required process step and a drawing-specified process

10　step from the category of closed terminal.　In a case where the check

box for "resin-covered circle terminal included" is selected in the

crimp-connecting step setting screen, the control unit 44 reads out a

required process step and a drawing-specified process step from the

category of resin-covered circle terminal.

15　　　The control unit 44 outputs the processing information screen in

which the required process step read out form the process step setting

table is displayed in red and the drawing-specified process step read

out from the process step setting table is displayed in yellow, from

the output unit 43.

20　　　FIG. 33 is a diagram showing the processing information screen

for wiring-related works/continuity check/appearance check in which

the required process step and drawing-specified process step are

displayed.　Unlike the processing information screen shown in FIG.

7, the processing information screen shown in FIG. 33 displays the

25　calculation factor input sections for continuity check in red, and the

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calculation factor input sections for appearance check in yellow.

That is, the processing information screen shown in FIG. 33

indicates that the continuity check is the required process step, the

appearance check is the drawing-specified process step, and the other

5 process steps may be arbitrarily performed.　Explanation of the

processing information screen for crimp-connecting,

insulation-displacement-crimping, and wiring preparation

works/wiring by using diagrams will be omitted.　However, the

required process step is likewise displayed in red and the

10 drawing-specified process step is likewise displayed in yellow for

these process steps.　Further, the names of all of the process steps

are displayed as navigators in the right of the processing information

screen.　For this navigator section, the required process step is

displayed in red, and the drawing-specified process step is displayed

15 in yellow.

By displaying the processing information screen in this manner,

the estimation requester can know the process steps for which

calculation factors must be input in order to estimate the processing

cost of a harness, at first glance.　Therefore, an inexperienced

20 estimation requester who can not figure out the process steps

necessary for manufacturing a harness from a diagram showing the

harness's completed state, can also easily know for which process

steps he/she should input calculation factors.

[Example 2]

25 Another detailed example according to the above-described

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embodiment will now be explained.   According to the
above-described embodiment, the operation time during which a
harness processing instrument is operated is calculated in the middle
of calculating the processing cost for each process step, and the
5 calculated operation time is displayed on the processing cost display
screen.

The present example will show a structure in which the amount
of electricity consumed in each process step is calculated based on
the operation time.   Because the amount of electricity consumed by
10 operation of harness processing instruments is presented, the
estimation requester can know the value of the harness for which
estimation is requested, not only from a financial aspect but also from
an aspect of environmental aspect.

The control unit 44 calculates the amount of consumed
15 electricity by using an electricity amount estimation function
indicated by an equation (27) below.

Electricity Amount = (logical amount of consumed electricity
demand ratio operation time of each process step)   ---(27)

The control unit 44 obtains the electricity amount by calculating
20 the product of logical amount of consumed electricity, electricity
demand ratio, and operation time in the respective process steps, and
adding up the obtained products.

To be more specific, logical amount of consumed electricity and
electricity demand ratio can be acquired from an environmental
25 impact information table which is pre-stored in the storage unit 41.

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FIG. 34 is a diagram showing the content of the environmental impact information table.

The environmental impact information table defines the logical amount of consumed electricity (Kw/h) and the electricity demand
5 ratio (%) in correspondence with each process step.   The control unit 44 reads out the logical amount of consumed electricity and the electricity demand ratio of each process step from the environmental impact information table.   The control unit 44 uses the operation time of each process step calculated in the above-described
10 embodiment as the operation time of each process step in the equation (27).

[Second Embodiment]

FIG. 35 is a diagram showing the structure of an estimation system according to a second embodiment of the present invention.

15   According to the estimation system 40 for harness processing of the first embodiment, all the estimation functions relating to harness processing are stored in the storage unit 41.   However, estimation functions may be externally acquired in accordance with necessity.

An estimation system 60 for harness processing shown in FIG.
20 35 is a system which acquires a latest estimation function by communicating with a server 50.   The estimation system 60 comprises a storage unit 61, an input unit 62, an output unit 63, a control unit 64, and a communication unit 65.

The storage unit 61, input unit 62, output unit 63, and control
25 unit 64 are equivalent to the storage unit 41, input unit 42, output unit

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43, and control unit 44 of the first embodiment.   The

communication unit 65 performs communication with the server 50.

The communication unit 65 is connected to the control unit 64, and is

also connected to the server 50 via a network N which is wired or

5 non-wired.

An estimation method by this estimation system 60 will now be

explained with reference to FIG. 36.

An estimation function for harness processing greatly changes in

accordance with improvement of work performance in a work site

10 where actual harness processing is carried out and innovation of

processing machines, etc.   And such changes happen quite often.

Therefore, a user who requests estimation of harness processing

needs to calculate the estimation of harness processing by using the

latest estimation function.

15   FIG. 36 shows a flowchart of an estimation method performed

by the estimation system 60.

In a case where an estimation function is not stored in the

storage unit 61 of the estimation system 60, or in a case where an

estimation function is stored in the storage unit 61 but is outdated, the

20 user operates the input unit 62 in order to establish communication

between the server 50 and the estimation system 60.   The control

unit 64 calls the server 50 via the communication unit 65, and

establishes communication with the server 50 (step S41).

The server 50 sends a message to the estimation system 60, in

25 order to prompt input of, for example, an authentication number and

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to determine whether the user or the estimation system 60 is entitled

to receive an estimation function.   The control unit 64 receives the

message via the communication unit 65, and outputs the message

from the output unit 63.   The user inputs an authentication number

5 given to him/her beforehand from the input unit 62.

The control unit 64 sends the authentication number to the server

50 via the communication unit 65.   The server 50 determines

whether the user or the estimation system 60 is entitled to receive an

estimation function based on the received authentication number.

10 That is, the server 50 performs authentication (step S42).

After authentication is finished in step S42, the server 50 sends a

message for the user to designate the kind of estimation function, to

the estimation system 60.   The control unit 64 receives the message

via the communication unit 65, and outputs the message from the

15 output unit 63.

The user designates an estimation function by operating the

input unit 62.   The user may partially designate necessary

estimation functions or may totally designate all necessary estimation

functions.

20   The control unit 64 sends data indicating the designated

estimation function to the server 50 via the communication unit 65

(step S43).   The server 50 reads out the designated estimation

function from an unillustrated built-in storage device, and sends the

read-out estimation function to the estimation system 60.

25   The control unit 64 receives the estimation function sent by the

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server 50 (step S44), and stores the received estimation function in the storage unit 61 (step S45).

A latest estimation function is stored in the storage unit 61 of the estimation function 60 by following step S41 to step S45.

5　Thereafter, the control unit 64 of the estimation system 60 performs the same estimation operation as that of the first embodiment in accordance with a program (step S46).　When the result of the estimation is obtained, the control unit 64 outputs the result of the estimation from the output unit 63 (step S47).

10　Since the estimation system 60 of the present embodiment comprises the communication unit 65 and acquires an estimation function from the server 50 as described above, the estimation system 60 can calculate the estimation of harness processing by using a latest estimation function.

15　Further, since the control unit 64 receives an estimation function after the server 50 performs authentication in step S42 and determines that the user or the estimation system 60 is the proper receiver of an estimation function, it is possible to prevent generally confidential estimation functions from being leaked to the outside.

20　[Third Embodiment]

FIG. 37 is a block diagram showing an estimation system 70 according to a third embodiment of the present invention.

The estimation system 70 calculates estimation of harness processing based on a condition given by a terminal 80, and sends the

25　calculation result to the terminal 80.

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The estimation system 70 comprises a storage unit 71, a communication unit 72, and a control unit 73.   The storage unit 71 and the control unit 73 are equivalent to the storage unit 41 and the control unit 44 of the first embodiment.   The storage unit 71 stores

5   estimation functions.   The communication unit 72 performs communication with the terminal 80.   The communication unit 72 is connected to the terminal 80 via a network N which is wired or non-wired, and is also connected to the control unit 73.

The operation of the estimation system 70 will now be explained

10   with reference to FIG. 38.

FIG. 38 shows a flowchart of an estimation method performed by the estimation system 70.

The estimation system 70 waits for reception.   If a communication route is opened and there is reception (step S51:

15   YES), the estimation system 70 communicates with the communication partner, and determines whether the communication partner is a person registered beforehand (step S52).   That is, the estimation system 70 determines whether the communication partner is a person to whom it is allowed to send an estimation result.   If the

20   communication partner is not a person to whom it is allowed to send an estimation result (step S52: NO), the estimation system 70 closes the communication route and returns to step S51.

In a case where the communication partner is the terminal 80 to which it is allowed to send an estimation result (step S52: YES), the

25   control unit 73 keeps communicating with the terminal 80 by

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maintaining the communication route, and receives processing

information regarding harness processing from the terminal 80 (step

S53).   The control unit 73 stores the processing information in the

storage unit 71, and performs estimation calculation in the same

5   manner as that of the first embodiment by using the processing

information.   That is, the control unit 73 performs estimation

calculation by using the communication unit 72 as the input unit 42

and the output unit 43 of the first embodiment (step S54).

When an estimation result is obtained, the control unit 73 sends

10   the estimation result to the terminal 80 via the communication unit 72

(step S55).   The sent estimation result is output to the user from the

terminal 80.

As described above, according to the present embodiment, the

estimation system 70 comprises the communication unit 72, receives

15   a processing condition from the terminal 80, performs estimation,

and sends the estimation result to the terminal 80.   Therefore, the

terminal 80 needs not to comprise a mechanism for storing estimation

functions or a mechanism for performing estimation calculation,

which makes the structure of the terminal 80 simple.   In other words,

20   an estimation of harness processing can be obtained with the terminal

80 having a simple structure.

Further, since the control unit 73 performs estimation calculation

after authenticating the terminal 80 in step S52 and determining that

the user or the terminal 80 is the proper receiver of an estimation

25   result, it is possible to prevent generally confidential estimation

results from being leaked to the outside.

The embodiments and examples of the present invention are not limited to the ones described above. Those embodiments and examples can be replaced with technical means ordinarily used by

5 those skilled in the art.

Various embodiments and changes may be made thereunto without departing from the broad spirit and scope of the invention. The above-described embodiments are intended to illustrate the present invention, not to limit the scope of the present invention.

10 The scope of the present invention is shown by the attached claims rather than the embodiments. Various modifications made within the meaning of an equivalent of the claims of the invention and within the claims are to be regarded to be in the scope of the present invention.

15 This application is based on Japanese Patent Application No. 2002-275299 filed on September 20, 2002 and including specification, claims, drawings and summary. The disclosure of the above Japanese Patent Application is incorporated herein by reference in its entirety.